OPERATING INSTRUCTIONS

TYPE 1206-B

UNIT AMPLIFIER

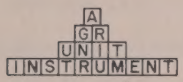
GENERAL RADIO COMPANY

OPERATING INSTRUCTIONS

TYPE 1206-B

UNIT AMPLIFIER

Form 1206-0100-E
January, 1962



GENERAL RADIO COMPANY
WEST CONCORD, MASSACHUSETTS, USA

SPECIFICATIONS

Power Output: With 300-v plate supply, 600-ohm load: from 10 cps to 50 kc, 3 w; from 5 cps to 100 kc, 1.5 w; at 250 kc, 0.5 w.

Distortion: Less than 1% harmonic distortion with 2-w output (2% at 3 w) into 600 ohms from 20 cps to 40 kc.

Pulse Response:	No Load	600 Ω
Droop in 30-cps square wave:	15%	20%
Approx rise time: 50 v peak-to-peak:	1 μsec	2 μsec
100 v peak-to-peak:	2 μsec	4 μsec
Max output, peak-to-peak:	260 v	120 v

Load Impedance: 600 ohms optimum. Blocking capacitor is 100 μf. (Internal impedance about 100 ohms.)

Input Impedance: 100,000 ohms in parallel with 35 μμf.

Frequency Response: Down less than 3 db at 2 cps and 500 kc at 10-v (or less) output, with gain control at maximum. See also Power Output, above.

Voltage Gain: Continuously adjustable. Maximum gain is 50 to 1 (34 db), with no load; 42.5 to 1 (32.6 db) into 600 ohms.

A-C Hum in Output: Less than 15 mv rms, with Type 1203 Unit Power Supply; less than 3 mv rms, with Type 1201-A Unit Regulated Power Supply.

Power Requirements: 300 v at 50 ma; 6.3 v at 2.7 amp.

Power Supply: Type 1203 Unit Power Supply is recommended. Amplifier plugs directly into any one of the Unit Power Supplies.

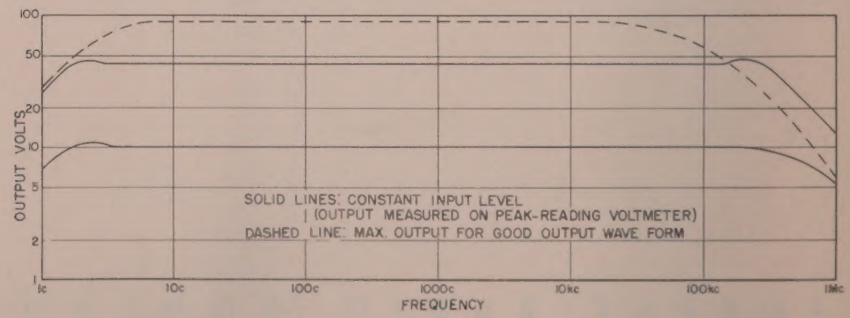
Accessories Supplied: Two connector channels for attaching power supply.

Mounting: Aluminum cabinet and chassis for bench mounting. Relay Rack panel (Type 480-P4U3) available for amplifier and power supply.

Dimensions: Width 9-7/8, height 5-3/4, depth 6-1/4 inches (250 by 150 by 160 mm), over-all.

Weight: 4 lb. (1.9 kg).

U.S. Patent Nos 2,659,775 and 2,802,907.



Frequency-Response with 600-Ohm Load.

TABLE OF CONTENTS

Section 1 INTRODUCTION 1

1.1 Purpose 1
1.2 Description 1

Section 2 OPERATING PROCEDURE 2

2.1 Power Supply 2
2.2 Input and Output Circuits 2
2.3 Frequency Response 3
2.4 Pulse Response 3

Section 3 SERVICE AND MAINTENANCE 3

3.1 General 3
3.2 Excess Distortion 4
3.3 Low Gain or Excess Hum 4
3.4 Test Voltages 4

PARTS LIST 6

WIRING DIAGRAM 7

THIS INSTRUMENT IS LICENSED UNDER PATENTS OF THE AMERICAN TELEPHONE AND TELEGRAPH COMPANY SOLELY FOR UTILIZATION IN RESEARCH, INVESTIGATION, MEASUREMENT, TESTING, INSTRUCTION AND DEVELOPMENT WORK IN PURE AND APPLIED SCIENCE.

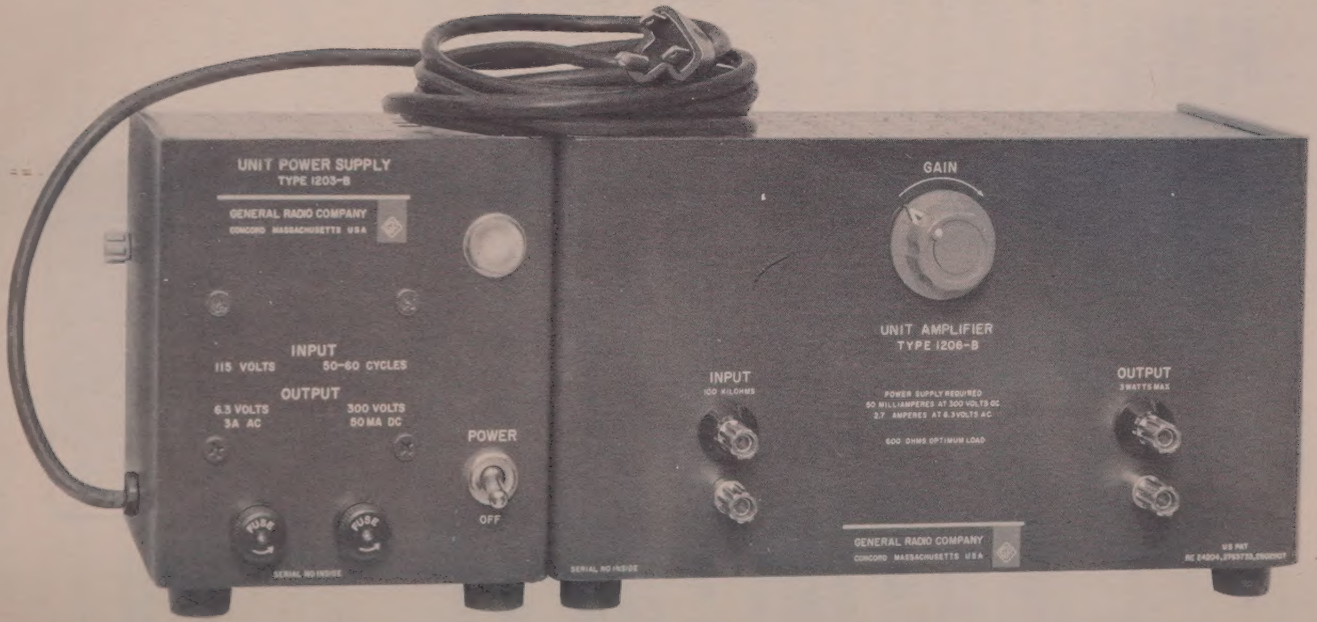


Figure 1. Panel View, Type 1206-B Unit Amplifier with Type 1203-B Power Supply

TYPE 1206-B
UNIT AMPLIFIER

Section 1
INTRODUCTION

1.1 PURPOSE. The Type 1206-B Unit Amplifier (Figure 1) is designed as a general-purpose laboratory instrument useful as a bridge amplifier, a driver for low-power electronic and electroacoustic devices, and as an amplifier for the Type 1210 Unit Oscillator and other low-power signal sources. The normal operating range covers the audio and ultrasonic frequencies.

1.2 DESCRIPTION. The Unit Amplifier uses a single-ended push-pull circuit,[1] with the advantage of push-pull operation of the output tubes and without the usual low- and high-frequency limitations of the output transformer. The circuit consists of a triode amplifier stage, a phase inverter, and series output tubes operated in push-pull parallel. Degenerative feedback is returned to the cathode of the input stage.

The elementary schematic diagram (Figure 2) shows the operation of the series push-pull output stage. Note that the drive for the upper tube (V3) is applied from grid to cathode and not from grid to ground. If either tube were replaced by a resistor, therefore, the other would act as an amplifier with gain, and the upper tube would give an output in phase with its input.

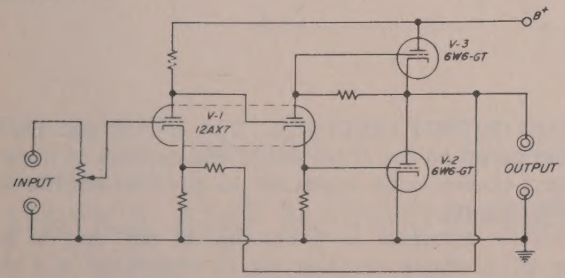


Figure 2. Elementary Schematic Diagram.

1. Peterson, A.P.G. and Sinclair, D.B., "A Single-Ended Push-Pull Audio Amplifier", Proc. IRE, January, 1952, pp. 7-11.

Section 2

OPERATING PROCEDURE

2.1 POWER SUPPLY. Connect an external power source to the connecting jack as shown in Figure 3. Recommended power sources are the Type 1203 Unit Power Supply, Type 1201 Unit Regulated Power Supply, and Type 1204 Unit Variable Power Supply. The power supply should be able to deliver 2.7 amp at 6.3 volts (60 cps) and 50 ma at 300 volts dc. The heater supply and the dc plate supply should not be interconnected. When using the Type 1204 Unit Variable Power Supply, set the output to 300 volts.

If the Type 1203 Unit Power Supply is used, it will not be possible to obtain the full 3 watts output if the line voltage is substantially below 115 volts. A Variac® autotransformer or other means of increasing line voltage should be used if the full 3 watts are desired. At line voltages of over 115 volts, an output of over 3 watts is obtainable; however, the amplifier should not be operated from the Type 1203 Unit Power Supply with a line voltage of over 130 volts.

The Type 1201 Unit Regulated Power Supply supplies 300 volts regulated power, and also has the advantage of reducing the hum output of the amplifier.

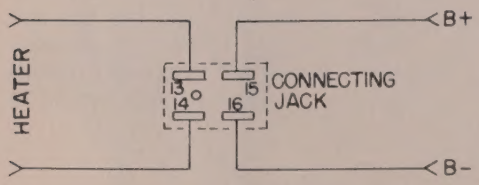


Figure 3.
Connection of External Power Source.

2.2 INPUT AND OUTPUT CIRCUITS. The INPUT and OUTPUT terminals are so indicated on the front panel. Be careful to keep the external input and output connections separate to prevent oscillation due to an external feedback path.

Each INPUT terminal is connected to one end of a logarithmic potentiometer (R1), whose variable tap is connected to a blocking capacitor that leads to the grid of the input stage. The input, therefore, may have a d-c component, which should be under 100 volts. The 100,000-ohm potentiometer (R1) should be turned fully clockwise for full gain.

Leakage in the 100-μf blocking capacitor in the output circuit results in a d-c voltage across the output terminals. The voltage is about 1 volt open-circuit, 0.1 volt with a 600-ohm load.

The optimum load is 600 ohms. Due to feedback, the actual source impedance is about 100 ohms, but the amplifier cannot supply enough current to develop 3 watts into a load impedance much smaller than 600 ohms.

2.3 FREQUENCY RESPONSE. The frequency ranges given for various power levels (refer to Specifications) are the ranges over which the output waveform is essentially sinusoidal for a sinusoidal input. Any given output is available over a wider frequency range than indicated, but the waveform is visibly distorted at frequencies much beyond those given.

High-frequency response is a function of amplitude, and is due to the limited frequency response of the phase inverter, which results in overloading of the phase inverter at high frequencies.

Although this series-tube operation permits a much better frequency response than that which is ordinarily possible with an output transformer and conventional push-pull circuit, the response is limited by the effective multiplication of the grid-to-ground capacitance of the upper tube by the gain of the output stage.

2.4 PULSE RESPONSE. The Specifications indicate that the rise time is a function of amplitude. This is due to the limited response of the phase inverter, which results in overloading of the phase inverter. At low levels the rise time of the phase inverter is improved by feedback. At sufficiently high levels the phase inverter is driven to cutoff. At cutoff, the impedance of the tube's output circuits is changed so that the circuit has a longer time constant and slower rise time. The period of time over which cutoff exists depends on the amplitude. The fall time is shorter, indicating that driving the phase inverter grid positive has less effect on the time constants of the phase inverter's output circuits.

With potentiometer R1 turned fully clockwise, a small overshoot appears on the output waveform when the amplifier is driven from a low-impedance pulse generator. To eliminate this overshoot, turn R1 slightly counterclockwise. The rise time, however, is best when R1 is near either end.

Section 3

SERVICE AND MAINTENANCE

3.1 GENERAL. The two-year warranty given with every General Radio instrument attests the quality of materials and workmanship in our products. When difficulties do occur, our service engineers will assist in any way possible.

In case of difficulties that cannot be eliminated by the use of these service instructions, please write or phone our Service Department, giving full information of the trouble and of steps taken to remedy it. Be sure to mention the serial and type numbers of the instrument.

Before returning an instrument to General Radio for service, please write to our Service Department or nearest district office (see back cover), requesting a Returned Material Tag. Use of this tag will insure proper handling and identification. For instruments not covered by the warranty, a purchase order should be forwarded to avoid unnecessary delay.

3.2 EXCESS DISTORTION. Excess distortion would probably be due to improper operation of the output tubes. Before replacing either of the tubes, check to see that the plate supply voltage (V3, pins 3 and 4) and the bias voltage (V2, pin 5) are correct. After replacing either V2 or V3, readjust R13 for minimum distortion. R13, a bias adjustment on V3, is set at the factory to give minimum distortion at 1 kc when delivering 3 watts into 600 ohms with a line voltage of 115 volts on the Type 1203 Unit Power Supply.

3.3 LOW GAIN OR EXCESS HUM. In the event of either low gain or excessive hum, check to see if V1 (12AX7) is defective, and replace it if necessary.

3.4 TEST VOLTAGES. The following table gives test voltages as an aid to trouble-shooting. Unless otherwise indicated, voltages are dc, to ground, with no input signal applied. A 20,000-ohm-per-volt multimeter was used.

TUBE		PIN	VOLTS TO GND
V1 (12AX7)	Plate	1	200
	Grid	2	0
	Cathode	3	1.6
	Heater	4	-8
	Heater	5	-8
	Plate	6	250
	Grid	7	High Impedance
	Cathode	8	40
	Heater	9	6.3 ac*

TUBE		PIN	VOLTS TO GND
V2 (6W6-GT)	Heater	2	6.3 ac**
	Plate	3	150
	Screen	4	150
	Grid	5	-16
	Heater	7	-8
	Cathode	8	0
V3 (6W6-GT)	Heater	2	6.3 ac**
	Plate	3	300
	Screen	4	300
	Grid	5	134†
	Heater	7	-8
	Cathode	8	150

* Between pins 4 and 9 and 5 and 9.
** Between pins 2 and 7.
† Use dc vacuum-tube voltmeter.

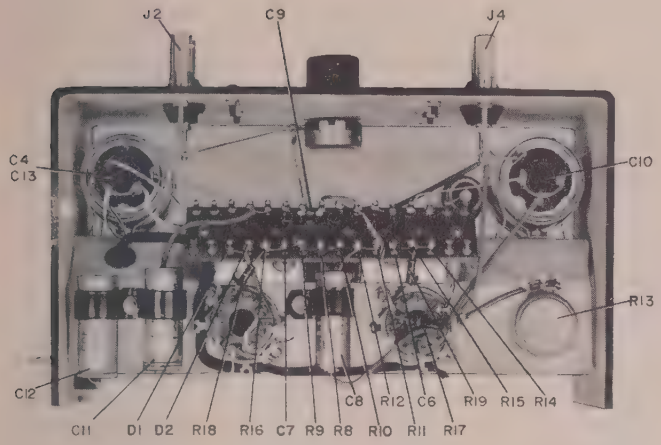


Figure 4. Top Interior View.

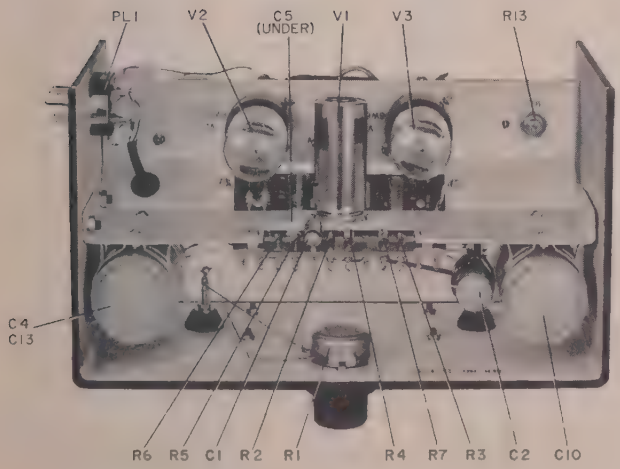


Figure 5. Bottom Interior View.

PARTS LIST

			PART NO. (Note A)
RESISTORS (Note B)	R1	100 k ±10%	POSC-12
	R2	1 M ±10% 1/2 w	REC-20BF
	R3	1 k ±10% 1/2 w	REC-20BF
	R4	200 ± 1% 1/2 w	REF-70
	R5	68 k ± 5% 1/2 w	REC-20BF
	R6	10 k ±10% 1/2 w	REC-20BF
	R7	13 k ± 1% 1/2 w	REF-70
	R8	1 M ±10% 1/2 w	REC-20BF
	R9	1.5 k ± 5% 1/2 w	REC-20BF
	R10	39 k ± 1% 1/2 w	REF-70
	R11	28.5 k ± 1% 1/2 w	REF-70
	R12	27 k ±10% 1/2 w	REC-20BF
	R13	5 M ±20%	POSC-11
	R14	6.8 M ± 5% 1/2 w	REC-20BF
	R15	1 M ±10% 1/2 w	REC-20BF
	R16	100 k ±10% 1/2 w	REC-20BF
	R17	4.7 M ±10% 1/2 w	REC-20BF
	R18	100 ±10% 1/2 w	REC-20BF
	R19	100 ±10% 1/2 w	REC-20BF
	R20	470 k ± 5% 1/2 w	REC-20BF
CAPACITORS (Notes C and D)	C1	0.1 ±10% 100 dcwv	COW-17
	C2	200 +100%-10% 10 dcwv	COE-6
	C4	25 +0-10% 350 dcwv	COEB-35
	C5	0.047 ±10% 400 dcwv	COW-25
	C6	0.1 ±10% 200 dcwv	COW-16
	C7	0.22 ±10% 100 dcwv	COW-17
	C8	10 +0-10% 250 dcwv	COE-33
	C9	39 μμf ±10% 500 dcwv	COM-20B
	C10	100 +0-10% 350 dcwv	COEB-35
	C11	16 +100%-10% 150 dcwv	COE-4
	C12	16 +100%-10% 150 dcwv	COE-4
	C13	75 +0-10% 350 dcwv	COEB-35
	D1	Crystal Diode	1N1692
	D2	Crystal Diode	1N1692
	J1	Binding Post	BP-5
	J2	Binding Post	BP-5
	J3	Binding Post	BP-5
	J4	Binding Post	BP-5
	PL1	Plug	CDMP-476-4
	V1	Tube	12AX7
	V2	Tube	6W6GT
	V3	Tube	6W6GT

NOTES

(A) Type designations for resistors and capacitors:

COE - Capacitor, electrolytic
COEB - Capacitor, electrolytic block
COM - Capacitor, mica
COW - Capacitor, wax
POSC - Resistor, variable, composition
REC - Resistor, composition
REF - Resistor, film

(B) All resistances are in ohms unless otherwise indicated by k (kilohms) or M (megohms).

(C) All capacitances are in microfarads unless otherwise indicated by μμf (micromicrofarads).

(D) C4 and C13 are parts of the same unit.

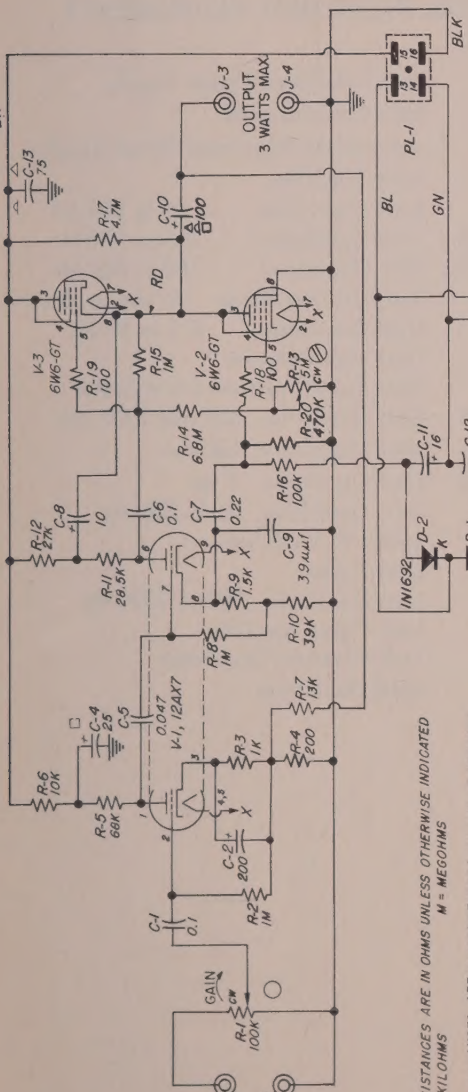


Figure 6. Schematic Diagram, Type 1206-B Unit Amplifier.

GENERAL RADIO UNIT INSTRUMENTS

Type 1201	Unit Regulated Power Supply	
Type 1203	Unit Power Supply	
Type 1205	Adjustable Regulated Power Supply	
Type 1206	Unit Amplifier	
Type 1208	Unit Oscillator	65 to 500 Mc
Type 1209-B	Unit Oscillator	250 to 920 Mc
Type 1209-BL	Unit Oscillator	180 to 600 Mc
Type 1210	Unit RC Oscillator	20 cps to .5 Mc
Type 1211	Unit Oscillator	0.5 to 50 Mc
Type 1212	Unit Null Detector	
Type 1213	Unit Time/Frequency Calibrator	
Type 1214-A	Unit Oscillator	400 and 1000 cps
Type 1214-D	Unit Oscillator	120 cps
Type 1214-M	Unit Oscillator	1 Mc
Type 1215	Unit Oscillator	50 to 250 Mc
Type 1216	Unit I-F Amplifier	
Type 1217	Unit Pulser	
Type 1218	Unit Oscillator	900 to 2000 Mc
Type 1219	Unit Pulse Amplifier	
Type 1220	Unit Klystron Oscillator	
Type 1361	UHF Oscillator	

GENERAL RADIO COMPANY

WEST CONCORD, MASSACHUSETTS

EMerson 9-4400 | Mission 6-7400

DISTRICT OFFICES

NEW YORK
Broad Ave. at Linden, Ridgefield, N. J.
Telephone N.Y. WOrth 4-2722
N.J. WHitney 3-3140

SYRACUSE
Pickard Bldg.
East Molloy Rd., Syracuse 11, N. Y.
Telephone GLenview 4-9323

PHILADELPHIA
1150 York Rd., Abington, Penna.
Telephone TUrner 7-8486
Phila., HAncock 4-7419

WASHINGTON
8055 13th St., Silver Spring, Md.
Telephone JUniper 5-1088

FLORIDA
113 East Colonial Drive, Orlando, Fla.
Telephone GArden 5-4671

CHICAGO
6605 West North Ave., Oak Park, Ill.
Telephone VIllage 8-9400

LOS ANGELES
1000 N. Seward St., Los Angeles 38, Calif.
Telephone HOllywood 9-6201

SAN FRANCISCO
1186 Los Altos Ave., Los Altos, Calif.
Telephone WHitecliff 8-8233

CANADA
99 Floral Pkwy., Toronto 15,
Telephone CHerry 6-2171

REPAIR SERVICES

EAST COAST
General Radio Company
Service Department
22 Baker Ave., W. Concord, Mass.
Telephone EMerson 9-4400

NEW YORK
General Radio Company
Service Department
Broad Ave. at Linden, Ridgefield, N. J.
Telephone N.Y. WOrth 4-2722
N.J. WHitney 3-3140

MIDWEST
General Radio Company
Service Department
6605 West North Ave., Oak Park, Ill.
Telephone VIllage 8-9400

WEST COAST
General Radio Company
Service Department
1000 N. Seward St., Los Angeles 38, Calif.
Telephone HOllywood 9-6201

CANADA
General Radio Company
Service Department
oral Pkwy., Toronto 15, Ont.
hone CHerry 6-2171

General Rc *ch, Switzerland*
Repres *Countries*

www.manualsplus.com
1022671

Printed in U.S.A.